RECORD OF DECISION
SOUTH BAY ASBESTOS AREA
SUPERFUND SITE

ALVISO DISTRICT
SAN JOSE. CALIFORNIA

SEPTEMBER 29, 1989

U.S. Environmental Protection Agency
Region 9

TABLE OF CONTENTS

FIGURES

TABLES

ATTACHMENTS

RECORD OF DECISION

DECLARATION STATEMENT

Site Name

South Bay Asbestos Area

Site Location

Community of Alviso
San Jose, California

Statement of Basis and Purpose

This decision document presents the selected remedial action for asbestos contamination within the South Bay Asbestos Area site, including the community of Alviso, located in San Jose, California. This document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. §§ 9601 et seq., and with the National Contingency Plan (40 C.F.R. Part 300). This decision is based on the administrative record for this site. The attached administrative record index (Attachment A) identifies the documents upon which the selection of the remedial action is based.

Assessment of The Site

Actual or threatened releases of asbestos from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

Description of Selected Remedy

The remedy described for the South Bay Asbestos Area site addresses the source of asbestos contamination located in the South Bay Asbestos site area. This remedy addresses those portions of the site not included in the Ring Levee Operable Unit. The Ring Levee Operable Unit was addressed in a separate Record of Decision (# RO9-88/026), dated September 29, 1988. The action described herein is designed to control the sources of contamination by addressing the principal threats at the site through a combination of remedial actions that will prevent emissions from areas most likely to have heavy traffic and resulting soil disturbance. The major components of the selected source control remedy include:

- Paving contaminated truck and industrial yards with asphalt or other suitable resurfacing material;

- Control of street dust emissions through monthly wet sweeping;

- Removal of asbestos waste debris (cement pipes, etc.);

- Cover requirements, inspections and deed restrictions on landfills; and

- Routine maintenance and monitoring.

The selected remedy will control the release of asbestos and will ensure the long-term protection of human health and the environment. The present worth cost of the selected remedy is $ 7,561,000, based upon a 8 percent interest rate with a 30-year design life.

Declaration

I have determined that the selected remedy for the South Bay Asbestos Area meets the remedy selection standards in CERCLA Section 121, 42 U.S.C. Section 9621, and the National Contingency Plan, by being protective of human health and the environment. I have also determined that the selected remedy attains the Federal and State requirements that are legally applicable to the hazardous substance or relevant and appropriate under the circumstances of the release or threatened release, and that the remedy is cost effective. The selected remedy utilizes permanent solutions to the maximum extent practicable for this site. Alternative treatment technology of the asbestos contamination within the community of Alviso was determined to be impracticable based upon effectiveness, technical feasibility, implementability, and cost factors.

Because this remedy will result in hazardous substances remaining on site, a review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, will be conducted at least once every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

John Wise	9.29.89
Daniel W. McGovern for Regional Administrator, EPA Region IX	Date

RECORD OF DECISION
SUMMARY

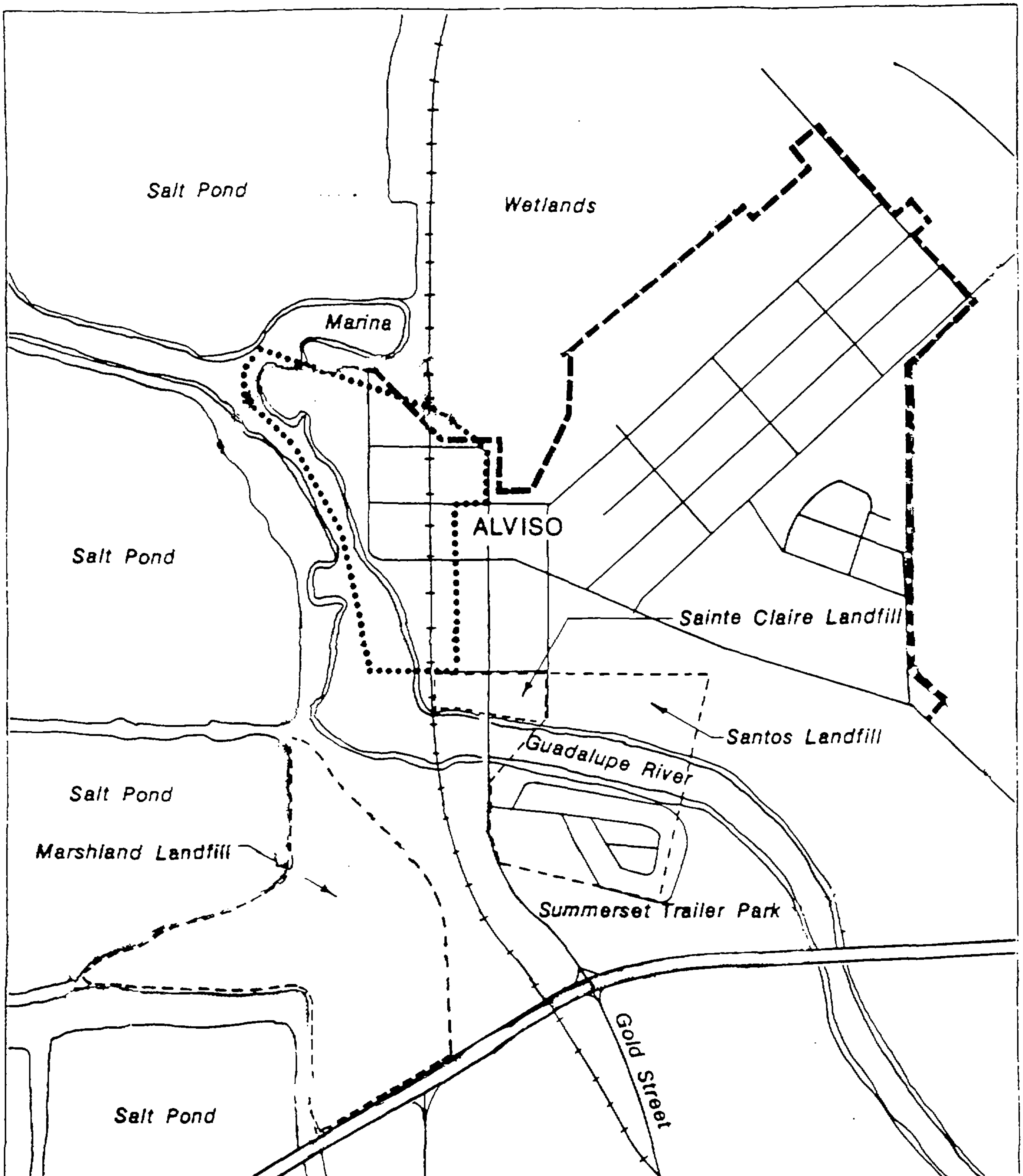
I. Site Name, Location, and Description

The South Bay Asbestos site is located at the northern end of the Santa Clara Valley and at the southernmost extent of San Francisco Bay (Figure 1). The study area, which includes the community of Alviso, consists of a variety of residential, commercial, light industrial, and agricultural land uses, comprising an area of approximately 550 acres (Figure 2). Alviso is the northernmost community in the City of San Jose, with about 1,900 residents. The oldest section of Alviso, located west of Gold Street and north of the Guadalupe River, is a designated National Register Historic District. The community is located in a quiet section of the Silicon Valley between Highway 237 to the south, rapidly growing Santa Clara to the west and south, and expanding office development to the east and northeast.

The site is highly susceptible to flooding because of its proximity to the Bay and to the Guadalupe River and Coyote Creek. Flood-producing storms occur within the area every few years, as evidenced by historical records and newspaper accounts. Two major streams that enter the Bay in the vicinity of the site are the Guadalupe River west and south of Alviso and Coyote Creek to the north and east. These rivers do not provide natural local drainage since they are leveed to prevent overbank flooding. The Guadalupe River was channelized in 1963 by the Santa Clara Valley Water District (SCVWD) to provide for greater flood flow capacity. The streams are under tidal influence and, therefore, discharge to the Bay is impeded during high tides. Numerous salt evaporation ponds are present between Alviso and the Bay, further impeding natural drainage into the Bay.

The development of agriculture in the region was facilitated by widespread ground water withdrawal from irrigation wells. Between 1934 and 1967, aquifer compaction due to over pumping caused the ground surface of the Santa Clara Valley to subside four to six feet, to an elevation below sea level, significantly increasing the potential for flooding. The land surrounding Alviso has been artificially raised with soil and debris fill, some containing asbestos, to offset the effects of subsidence.

The community of Alviso is adjacent to Bay wetlands. Near Alviso, a fragment of remaining marshland survives as the New Chicago Marsh, a National Wildlife Refuge about 300 acres in size. The Refuge has an active public education program through



LEGEND

•••••••• Historic District Boundary

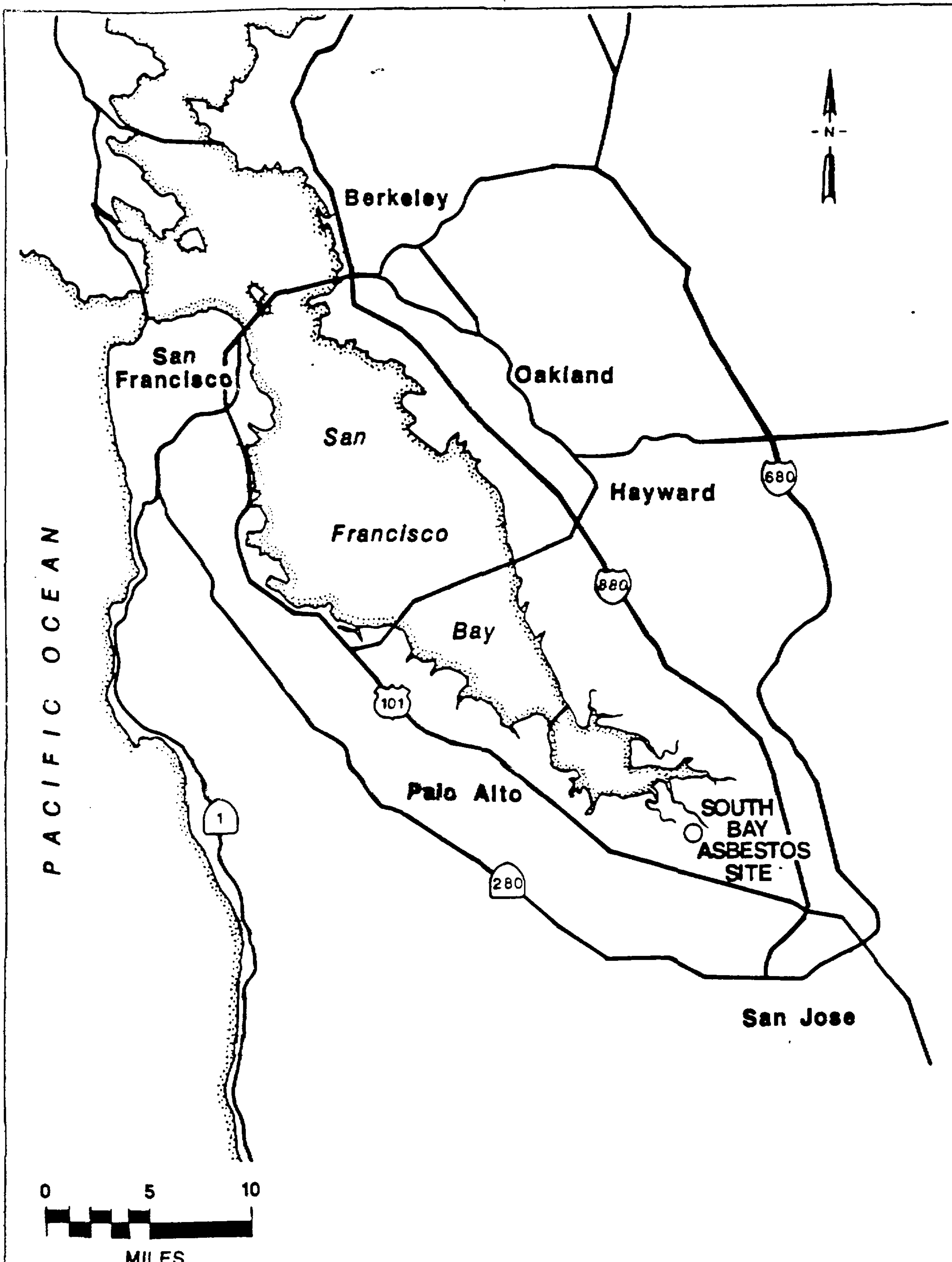
– – – – Landfill Boundary

▬ ▬ ▬ Existing Ring Levee

0 500 1000 2000

FEET

Project No.	South Bay Asbestos Site	SITE LOCATION MAP	Figure
288-FS1	Camp Dresser & McKee Inc.		2



Project No.	South Bay Asbestos Site	REGIONAL LOCATION MAP	Figure
288-FS1	Camp Dresser & McKee Inc.		1

its Environmental Education Center, located about a mile northeast of the community and administered by the U.S. Fish and Wildlife Service.

The wetlands adjacent to Alviso are a significant wildlife habitat because they provide an interface between fresh and salt water environments. The wetlands support several endangered or threatened species, including the Salt Marsh Harvest Mouse (Reithrodontomys raviventris), California Clapper Rail (Rallus longirostris obsoletus), Golden Eagle (Aquila chrysaetos), and Peregrine Falcon (Falco peregrinus). The Burrowing Owl is also a protected species of special concern. Small mammals and a great number of birds and waterfowl species use the wetlands and surrounding "upland" habitats (i.e., land elevated above the water level of the marsh).

II. Site History and Enforcement Activities

Asbestos-related manufacturing began in the Alviso area in the early 1950s. The Keasby & Mattison Company operated an asbestos-cement pipe manufacturing plant about 4 miles south of the site at 2885 Lafayette Street, Santa Clara, from August 1953 through June 1962. CertainTeed Corporation purchased Keasby & Mattison Company on June 1, 1962, and manufactured asbestos-cement pressure and sewer pipe and fittings until June 9, 1982. According to company employees, two or three truckloads of scrap pipe, machining waste, material from settling basins, and bag house waste were transported to local landfills daily. Several landfills were located within the site boundaries, including the Santos Landfill, Marshland Development Corporation Landfill (also known as the Hoxie Landfill, the Edgewater Landfill, the Leslie Salt Landfill, or the "fill dump"), and the Sainte Claire Corporation Landfill. Evidence indicates that all three landfills received asbestos-containing wastes. It has been reported that numerous Alviso residents used the waste asbestos-cement pipe to drain excess water from their properties before curbs and gutters were installed. Several areas within the Alviso site have been filled with asbestos-containing soils to improve flood protection. Some of this fill material contained asbestos waste.

In early 1983, Alviso was flooded by Coyote Creek as a result of heavy rains. The City of San Jose constructed a levee around the town in order to pump out the flood water. The levee material was taken from the Raisch Quarry in southern San Jose, and was later found to contain asbestos.

In August of 1983, the Santa Clara Valley Water District (SCVWD) initiated construction of an outfall structure at the Guadalupe River levee. Excavation occurred on property owned by the City of San Jose and SCVWD. This activity was observed by a California Occupational Safety and Health Administration (CAL-OSHA) inspector. The inspector collected samples of the excavated material because he suspected the material to be asbestos waste debris. The samples were analyzed by the Department of Health Services (DHS) Air and Industrial Hygiene Laboratory and they confirmed the inspector's suspicions. The samples contained concentrations of asbestos ranging from 20 to 40 percent. CAL-OSHA referred the situation to DHS. After confirming the presence of asbestos in the Guadalupe River levee, DHS ordered SCVWD to remove all the asbestos-contaminated soil. Removal of the contaminated soil took place between August and December 1983.

In September 1983, DHS collected soil samples from 20 random locations within the community of Alviso. The sample results indicated that asbestos was randomly distributed throughout the community of Alviso, including the Alviso Ring Levee. Based on the soil results, DHS initiated California Hazardous Waste Site Ranking procedures to include the community on the State Superfund list. The Community was listed 10th on the State Superfund list in December of 1983.

In June of 1984, EPA proposed the site for inclusion on the National Priority List. The site was approved for the NPL in October 1984, with a score of 44.68.

In 1985 DHS initiated an Operable Unit Feasibility Study (OUFS) for the Ring Levee (see Figure 2). DHS' OUFS was completed in April 1986 and recommended a clean soil cover for the levee. However, later that year, DHS determined that remedial funds were not available and referred the Ring Levee and the remainder of the site to EPA for further investigation and possible remediation.

EPA initiated a Remedial Investigation/Feasibility Study for the overall South Bay Asbestos site in 1986. The RI/FS was completed in February 1989. EPA also conducted several emergency clean up actions to immediately reduce asbestos exposure, including paving a lot adjacent to the George Mayne School, paving an unpaved section of Spreckles Avenue, removing an asbestos debris pile and chip sealing the road and parking lot at the Environmental Education Center, and spraying the Ring Levee with a dust suppressing polymer in 1986 and again in 1987. EPA accelerated action on the Feasibility Study for the Ring Levee, separating it from the overall investigation and releasing an Operable Unit Feasibility Study (OUFS) April 1988.

Also in April 1988, EPA and the City of San Jose signed a Consent Agreement which requires the City to maintain and periodically reapply sealant on the ring levee, and submit a plan to address the contamination at the Environmental Education Center. In July 1988, the Ring Levee was sprayed again by the City of San Jose.

In September 1988, EPA signed a Record of Decision (ROD) selecting a vegetated soil cover for the Ring Levee. EPA has been negotiating with the City of San Jose and Raisch Corporation and subsequently entered into negotiations for carrying out the remedial action for the Ring Levee Operable Unit. The City and Raisch have proposed to remove the levee rather than cover it with soil as was specified in the 1988 ROD. Upon conclusion of negotiations, opportunity will be provided for public comment on the revised plans for remediation of the levee contamination, and a Consent Decree will be lodged in Federal Court.

EPA has identified several potentially responsible parties (PRPs) for the South Bay Asbestos site. These PRPs include the City of San Jose, Raisch Corporation, Certainteed Corporation, Leslie Salt, Santos and Sainte Claire landfills and owners and operators of various industrial yards in Alviso. These PRPs either have provided, disposed of, transported, or arranged for transport of asbestos material, or are owners or operators of property where asbestos has been or is threatened to be released. General notice letters have been provided to these parties.

III. Community Participation

All requirements for public participation as specified in Section 113(k)(2)(B)(i-v) and Section 117 of CERCLA have been satisfied. The Remedial Investigation and Feasibility Study and Proposed Plan Fact Sheet for the South Bay Asbestos Site were made available to the public in the administrative record file and information repositories at the EPA Docket Room in Region 9 (San Francisco), the San Jose Public Library (Alviso Branch) in Alviso, and the Family Health Foundation in Alviso. Notices of the availability of these documents were published in the San Jose Mercury News and local Hispanic news publications on February 8, 1989. The public comment periods on the Proposed Plan was held from February 8 through April 14, 1989.

In addition, a public meeting on the Proposed Plan and Feasibility Study (FS) was held February 15, 1989, at the Star of the Sea Church in Alviso. At this meeting, EPA answered questions about the problems being addressed at the site and remedial alternatives under consideration. Responses to public comments made during the meeting, as well as to comments on the Proposed Plan and FS are provided in the Responsiveness Summary, Attachment B of this ROD.

IV. Scope and Role of Response Action

In evaluating the nature of the asbestos contamination problems in Alviso, EPA divided the remediation into two parts, addressing the ring levee as a separate operable unit apart from the rest of the site. As previously mentioned, EPA already signed a Record of Decision for the Ring Levee Operable Unit, and is negotiating with potentially responsible parties for the design and construction of a final remedy for the ring levee.

This ROD addresses the asbestos contamination found in the remainder of the site, (i.e.: those areas not addressed in the Ring Levee Operable Unit.) The remedial objective of this ROD is to control releases of asbestos to the atmosphere from contaminated soils and landfills on the site. This overall site ROD will be the final source control response action for the site.

V. Site Characteristics

Asbestos is the only identified hazardous substance at the South Bay Asbestos site. Soil, air, surface water, sediments, and groundwater were sampled for asbestos as part of the site remedial investigation. Asbestos was determined to be present in soil and air at levels that could pose a threat to public health and the environment. Asbestos was detected randomly distributed in soils throughout Alviso. Soil concentrations ranged from less than 1 percent to 40 percent asbestos (as measured by optical microscopy). Asbestos measured in air samples collected within the town during a 3 month study were nearly an order of magnitude higher than that measured in upwind samples. The measured concentrations of airborne asbestos were compared to wind speed and direction, but no correlation could be made. The Remedial Investigation concluded that wind erosion alone was not a significant mechanism for releasing asbestos from the soil. The highest single asbestos concentration recorded during the air study was measured at the State Street air station adjacent to industrial yards. Atmospheric levels of asbestos were determined to have resulted primarily from vehicular traffic on unpaved roads, truck and industrial yards, and other activities within the town that disturb surface soils, releasing the fibers to the air.

VI. Summary of Site Risks

A. Contaminant Information

Asbestos is a generic term referring to two groups of naturally-occurring hydrated silicate materials having a fibrous crystalline structure. Chrysotile fibers belong to the serpentine group; actinolite, amosite, anthophyllite, cummingtonite, crocidolite, and tremolite belong to the amphibole group. Asbestos fibers have been widely used because of their high tensile strength and flexibility and their noncombustible, nonconducting, and chemical-resistant properties. The fibers have been used in insulation, brake linings. floor tile, plastics, cement pipe, paper products, textiles, and building products.

Asbestos is a known human carcinogen and has been the subject of numerous epidemiological studies. There is no threshold level of exposure below which there is no risk. The primary diseases that have been associated with asbestos exposure are asbestosis, lung cancer, and mesothelioma; others include cancers of the larynx, pharynx, gastrointestinal tract, kidney, and ovary, as well as respiratory diseases such as pneumonia.

Lung cancer is currently responsible for the largest number of deaths from exposure to asbestos. It has been associated with exposure to all the principal commercial asbestos fiber types. Excessive lung cancer rates have been documented in groups of workers involved with the mining and milling of asbestos and the manufacture and use of asbestos products. Studies in which the extent of exposure can be approximated provide evidence that lung cancer increases linearly with both level and duration of exposure.

Human studies have also shown that exposure to asbestos can cause mesothelioma, a cancer that occurs as thick diffuse masses in the serous membranes (mesothelia) that line body cavities. Mesothelioma occurs in the pleura (the membrane that surrounds the lungs and lines the lung cavity) and the peritoneum (which surrounds the abdominal cavity). Epidemiological studies suggest that the incidence of mesothelioma is related to dose and time from first exposure.

Asbestosis, which involves fibrosis of lung and pleural tissues, is another serious chronic disease associated with high levels of exposure to asbestos. A full discussion of the health effects of asbestos is found in the EPA document Airborne Asbestos Health Assessment Update, EPA 600/8-84-003F, June 1986.

B. Exposure Assessment

The following exposure pathways were evaluated to determine risks to human health and the environment:

- Lifetime exposure of residents by inhalation of ambient air;

- Lifetime exposure of residents by inhalation of airborne asbestos generated by trucks in unpaved truck and industrial yards;

- Exposure of children by direct contact with and subsequent incidental ingestion of asbestos-contaminated soil in non-residential areas (i.e., vacant lots); and

- Lifetime exposure of residents by incidental ingestion of asbestos-contaminated soil during outdoor activities.

These pathways were selected for their likelihood and frequency of occurrence, and for their potential to generate asbestos levels that may be of concern to human health.

The potentially exposed population includes the approximately 1,870 individuals who reside in Alviso and workers who may be employed in the town. The Alviso population is highly mobile; among those residing in Alviso in 1980, only 38 percent were living in Alviso in 1975. Approximately 10 percent of the Alviso population was under 5 years of age and 4.5 percent was over 65 years of age. Thirty-two percent of the population in 1980 was between 5 and 20 years of age.

Risks from the pathways listed above were characterized by first comparing information on the presence and concentrations of asbestos in the sampled environmental media to Applicable or Relevant and Appropriate Requirements (ARARs) identified for the South Bay site. Because asbestos ARARs were not available for all of the sampled environmental media, a quantitative risk characterization was also conducted. In this evaluation, estimates of potential asbestos exposures through each pathway were combined with asbestos-specific toxicity values to predict potential risks associated with the site. For each pathway, an exposure scenario was developed based on assumptions about the environmental behavior and transport of asbestos, and the extent, frequency and duration of exposures. These factors were used to predict potential risks from exposure to asbestos in both average and maximum plausible exposure cases.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g. 1×10^{-6} or 1E-6). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

As shown in Table 1, the average case risks for the EPA onsite sampling stations (10^{-6} to 10^{-4}) were slightly higher than those at either the upwind (10^{-6} to 10^{-5}) or downwind (10^{-6} to 10^{-5}) sampling locations. Because of many uncertainties, these

TABLE 1

SUMMARY OF EXCESS INDIVIDUAL LIFETIME CANCER RISKS FOR EXPOSURE TO ASBESTOS AT THE SOUTH BAY SITE

Exposure Pathway[a]	Average Case	Maximum Case
Inhalation - Ambient Air		
Station 1 (off-site/upwind)	1×10^{-6} - 3×10^{-5}	7×10^{-6} - 2×10^{-4}
Stations 2-4 (on-site)	8×10^{-6} - 2×10^{-4}	6×10^{-5} - 2×10^{-3}
Station 5 (off-site/downwind)	1×10^{-6} - 5×10^{-5}	9×10^{-6} - 3×10^{-4}
Inhalation - Activity Generated Airborne Asbestos		
Truck Traffic on Unpaved Surfaces		
Residents Inhaling:		
Dust from Truckyards	NC	$>3 \times 10^{-3}$
Dust from Unpaved Roadways	NC	$>3 \times 10^{-3}$
Street Dust from Paved Roadways	NC	$>3 \times 10^{-3}$
Ingestion of Soil		
Children Playing on Non-Residential Areas (i.e., vacant lots)	NC	3×10^{-5}
Lifetime Exposure from:		
Alviso Yards	NC	5×10^{-5}
Trailer Park Yards	NC	6×10^{-5}

NC - Not calculated because geometric mean soil level was below the detection limit.

[a] The potential size of the populations exposed are estimated to be: <560-1,870 for inhalation of asbestos in ambient air and ingestion exposure to asbestos in soil; <150-600 for children/teenager exposure pathways; <100-1,000 for adult gardening scenarios; <560-1,870 for inhalation of vehicle-generated dusts by residents. The potential size of the worker population is not known.

risk results should be interpreted as order of magnitude estimates. (See Appendix I for a full discussion of uncertainties involved with asbestos measurement and risk quantification.)

For comparison, a different study evaluating lifetime inhalation risks associated with exposure to airborne asbestos at other locations in California was examined (Ambient Asbestos Concentrations in California; Science Applications Inc. (SAI), 1983). The excess lifetime cancer risks in these other California locations were predicted to be in the 10^{-6} to 10^{-4} range. There are uncertainties associated with these risk estimates as well, and they too should be interpreted with caution. For example, the conversion factor between analytical techniques adds an element of uncertainty to the risk calculation.

Experiments conducted by DHS (1986) were used to evaluate risks associated with inhalation of vehicle-generated dusts. Only a few experimental sample data values were available, thus, there are uncertainties associated with these pathways of exposure. Based on the DHS data, the excess lifetime cancer risks for maximum case scenarios of exposure were all estimated to exceed 10^{-3}. This risk level is the highest value presented in EPA's Health Risk Table (Table 1).

Ingestion risks were predicted for children playing in soil and residents contacting soil in yards. The ingestion risk for the maximum case scenario was between 10^{-4} and 10^{-5} for children and in the 10^{-5} range for adult residents.

The inhalation of airborne asbestos from physical disturbance of soils was found to be the exposure pathway presenting the most significant risk to human health. Therefore, remedial alternatives were developed to focus on contaminated areas with the highest potential for disturbance. For lack of a health-based standard for asbestos in soils, EPA has established a remediation goal of 1 area percent as determined by Polarized Light Microscopy (PLM). Remediation will be required for targeted areas with high potential for soil disturbance, which are found to contain greater than 1 area percent asbestos by PLM. This cleanup goal is consistent with remedial action taken at similar Superfund sites. A detailed explanation of the rationale for this cleanup goal is provided in Appendix I.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD may present an imminent and substantial endangerment to the public health, welfare or environment. Based on the fact that asbestos is a known human carcinogen with no known threshold, asbestos exists randomly in soils throughout Alviso and physical activity can release asbestos into the air, and that on-site risk has been demonstrated to be greater than immediately off-site, EPA has determined that remediation is appropriate.

VII. Applicable or Relevant and Appropriate Requirements (ARARS)

Under Section 121(d) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. § 121 (d), remedial actions must attain a degree of clean-up which assures protection of human health and the environment. Additionally, remedial actions that leave any hazardous substance, pollutant, or contaminant on-site must meet a level or standard of control that at least attains federal and more stringent state standards, requirements, limitations, or criteria that are "applicable or relevant and appropriate" under the circumstances of the release. These requirements, known as "ARARs", may be waived in certain instances. Additionally, only substantive (in contrast to administrative) federal and state requirements need to be followed.

"Applicable" requirements are those clean-up standards, environmental protection requirements, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant or contaminant, remedial action, location or other circumstance at a CERCLA site. "Relevant and appropriate" requirements are clean-up standards, environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not directly "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site such that their use is well-suited to the particular site. For example, requirements may be relevant and appropriate if they would be "applicable" but for jurisdictional restrictions associated with the requirement.

The determination of which requirements are "relevant and appropriate" is somewhat flexible. EPA and the State may consider the type of remedial actions contemplated, the hazardous substances present, the waste characteristics, the physical characteristics of the site, and other appropriate factors in identifying ARARs. It is possible for only part of a requirement to be considered relevant and appropriate.

Types of ARARS

There are three types of ARARs. The first type includes contaminant-specific requirements. These ARARs set limits on concentrations of specific hazardous substances, pollutants, and contaminants in the environment. Examples of this type of ARAR are ambient water quality criteria and drinking water standards. The second type of ARAR includes location-specific requirements that set restrictions on certain types of activities based on site characteristics. These include restrictions on activities in wetlands, floodplains, and historic sites. The third type of ARAR includes action-specific requirements. These are technology-based restrictions which are triggered by the type of action under consideration. Examples of action-specific ARARs are Resource Conservation and Recovery Act (RCRA) regulations for waste treatment, storage and disposal.

ARARs must be identified on a site-specific basis from information about specific contaminants at the site, specific features of the site location, and actions that are being considered as remedies. EPA has continued to refine the identification of applicable or relevant and appropriate requirements (ARARs) for the proposed remedial alternatives. The list of ARARs below is more expansive than described in the Feasibility Study Report. However, the addition of ARARs to this list does not significantly alter the scope, performance or cost of the remedy. Accordingly, this is a minor change from the earlier remedy selection documentation.

The ARARs identified for this Record of Decision are the substantive provisions of the following:

Contaminant-Specific ARARs

1. Clean Air Act, National Emission Standards for Hazardous Air Pollutants (NESHAPs) regulations (40 C.F.R. §§ 61.153 and 61.147); California Bay Area Air Quality Management District (BAAQMD) regulations (Reg. 11, rule 2, 305.3.1).

NESHAPS, and similar BAAQMD regulations, require either "no visible emissions", specified cover requirements, or alternative approved control methods for inactive asbestos disposal sites; these requirements are ARARs for the completion of the remedy at the Site. The NESHAPs requirement for adequate wetting of asbestos materials for emissions control and dust suppression is an ARAR for the implementation of the remedy at the Site.

2. Toxic Substances Control Act (TSCA) and Asbestos Hazard Emergency Response Act (AHERA) regulations, 40 C.F.R. 763.

EPA has promulgated regulations under TSCA and AHERA (Subchapter II of TSCA) related to the inspection and management of asbestos-containing material in schools. These regulations utilize polarized light microscopy (PLM) as a measurement technique for detecting asbestos; the use of this measurement technique for asbestos is relevant and appropriate to the cleanup of the South Bay Asbestos Area site.

Location-Specific ARARs

3. National Historic Preservation Act, 16 U.S.C. §470f; Historic Sites Act, 16 U.S.C. §§461 et seq.; Archaeological and Historic Preservation Act, 16 U.S.C. §§469 et. seq.; Executive Order (E.O.) 11593 (Protection and Enhancement of the Cultural Environment, May 13, 1971); 40 C.F.R. §6.301; and 36 C.F.R Part 800)

Federal Agencies are required to consider the effects of their actions upon designated or potential historic, architectural, archaeological, and cultural sites and natural landmarks. The older section of Alviso is listed in the National Register of Historic Places. To the extent that remedial activities may impact this section and other potentially protected areas of the Site, the substantive requirements of these statutes, orders, and regulations are ARARs.

4. McAteer-Petris Act and regulations (California Government Code, Title 7.2, §§ 66600 et. seq.; California Administrative Code (CAC) Title 14, Div. 5, Sec. 10110 et. seq.)

The McAteer-Petris Act established the San Francisco Bay Conservation and Development Commission (BCDC), which regulates activities adjacent to the Bay through the San Francisco Bay Plan document and permit requirements. Although remedial activities conducted onsite are exempted from permits (CERCLA § 121(e)(1), 42 U.S.C. § 9621(e)(1)), the substantive requirements of the Bay Plan are ARARs, to the extent that a BCDC permit would otherwise be required.

5. Endangered Species Act and regulations (16 U.S.C. § 1531 et seq.; 40 C.F.R. § 6.302(h); 50 C.F.R Parts 17 and 402.

Section 7 of the Endangered Species Act, 16 U.S.C. § 1536, requires Federal agencies to insure that their actions are not likely to jeopardize the continued existence of any endangered species or cause adverse modifications of critical habitat. Endangered species (including Salt Marsh Harvest Mouse and California Clapper Rail) have been identified in wetland habitat adjacent to the Site. Section 7 and related regulatory requirements are therefore ARARs.

6. U.S. Fish and Wildlife Service Mitigation Policy, 46 Fed. Reg. 7644-7663 (Jan. 23, 1981).

This policy defines four resource categories of impacted habitats, and establishes mitigation goals and guidelines for each category. According to USFWS, the mitigation goal for any losses of habitat values for the wetlands near Alviso is no net loss of in-kind habitat values.

7. Clean Water Act, Section 404 (33 U.S.C. § 1344) and regulations, 40 C.F.R. 230 et. seq.; Executive Orders 11988 (Floodplain Management) and 11988 (Protection of Wetlands), May 24, 1977; 40 C.F.R. 6.302 (a) and (b) and 40 C.F.R. Part 6, Appendix A.

These ARARs address wetlands protection and floodplain management. The site is located in a floodplain and adjacent to wetlands. Federal agencies are required to avoid, to the extent possible, adverse impacts from destruction of wetlands, and avoid support of new construction in wetlands if a practicable alternative exists. Section 404 and regulations mandate that dredged or fill material should not be discharged into aquatic ecosystems (in this case wetlands) unnecessarily.

Action-Specific ARARs

8. Occupational Safety and Health Act (OSHA) regulations, 29 C.F.R. 1910.1000 and 1910.1001.

OSHA has set a Permissible Exposure Limit (PEL) for asbestos fibers at .2 fibers per cc for occupationally exposed workers. The PEL was intended for workplace exposures (8 hours per day, 40 hours per week, 52 weeks per year) and not for continuous ambient exposures. The PEL is an ARAR as an upper limit for all exposures, but would not be protective for the exposure scenarios used in the risk assessment. The selected remedy will ensure that actual ambient exposure levels are lower than the limit established by this ARAR, and protective of human health and the environment. This ARAR could also be categorized as a contaminant-specific ARAR, since it is asbestos-specific.

VIII. Description of Alternatives

The analysis of remedial technologies, presented in the feasibility study report, resulted in the development of four alternatives for site remediation. These alternatives are summarized below.

Alternative No. 1 - No Action

The no action alternative serves as a baseline for comparing all other alternatives. Under the No Action alternative, no cover or removal activity would occur to reduce or prevent emissions of soil containing asbestos. Risk to the community would remain unabated. The only site activities which would occur under No Action would be site air monitoring and soil sampling, and revision of the Public Health Evaluation (PHE). These activities would occur at 5-year intervals as required under CERCLA § 121 (c) (42 U.S.C. Section 9621(c)), since wastes would be left on site.

Alternative No. 2 - Paving Truck and Industrial Yards/Wet Sweeping of Streets/ Off-Site Disposal of Waste Material as Required/ Institutional Controls

Alternative No. 2 involves (1) paving asbestos contaminated truck and industrial yards comprising a maximum estimated area of approximately 128,500 square yards; (2) wet sweeping of Alviso streets on a monthly basis, using a conventional street sweeper preceded by a water truck; (3) locating and removing obvious asbestos sources such as pipes, and disposing of them in an off-site landfill; (4) placing of deed restrictions on landfill subunits, after verifying NESHAPs cover thickness; and (5) establishing institutional controls to ensure maintenance of the remediation. The long-term effectiveness of this alternative would be high because paving the truck and industrial yards and sweeping of streets would eliminate two primary sources of airborne asbestos. Potential risks from soil disruption during paving will be minimized by employing dust control. This remedy is anticipated to take 1 to 2 years to complete.

Alternative 2, as originally proposed, called for a one time vacuum sweeping of Alviso streets to remove debris generated by paving construction. Street sweeping was abandoned in Alviso due to the asbestos problem, and a considerable amount of dust had accumulated in the streets. In response to comments received during the public comment period, the City of San Jose is conducting monthly street sweeping with a conventional street sweeper preceded by a water truck. This has demonstrated to effectively remove debris while emitting a minimal amount of dust. EPA considers regular wet sweeping on a monthly basis to be more practical and beneficial than one-time vacuum sweeping. This change does not significantly alter the scope, cost or performance of the remedy as originally proposed.

Prior to resurfacing, all identified truck and industrial yards and other contaminated unpaved areas subject to heavy vehicular traffic will be sampled extensively to determine more specific paving requirements. To date, only random samples have been collected from a select number of yards, which identified an asbestos problem in these areas. Paving will be required on lots where asbestos is found in levels exceeding 1 area percent by PLM, which also receive or have future potential to receive heavy vehicular traffic. The specific areas to be remediated will be delineated during the design phase of the project.

Alternative No. 3 - Paving Truck and Industrial Yards, Sainte Claire Landfill, and 50% of Alviso Unpaved Parking Lots; Soil Cover on 50% of Residential Yards and Vacant Lots/ Wet Sweeping of Streets/ Off-Site Disposal of Waste Materials/ Institutional Controls

Alternative No. 3 involves all cover and removal activities as described for Alternative No. 2, plus the placement of additional cover on low to medium risk areas. These areas include vacant lots, landfills, yards, gardens, and businesses with exposed soil or debris. The alternative would involve resurfacing 50 percent of asbestos contaminated parking lots, driveways, unpaved roadways between Marshland Landfill and Gold Street, and the Sainte Claire Landfill. Approximately 50 percent of vacant lots, yards, and gardens would be covered with a vegetated soil cover. Institutional controls such as long-term maintenance agreements would be implemented to ensure long-term integrity of asphalt and soil covers. The effectiveness of Alternative No. 3 in reducing asbestos exposure would be slightly better than Alternative No. 2, because of the additional asphalt and soil cover. The increase in effectiveness cannot be quantified and is considered marginal in terms of reducing exposure to Alviso residents. Moreover, because of the larger areas involved, this alternative is much more costly than Alternative No. 2. This alternative is anticipated to take 3-1/2 to 5 years to complete.

Alternative No. 4 - Paving Truck and Industrial Yards, Sainte Claire Landfill, and 100 % of Unpaved Parking Lots/ Soil Cover on 100% of Residential Yards and Vacant Lots/ Wet Sweeping of Streets/ Off-Site Disposal of Waste Material/ Institutional Controls

Alternative No. 4 is identical to Alternative No. 3 except that No. 4 would remediate 100 percent of all areas with detectable asbestos. Due to the larger areas targeted for covering, Alternative No. 4 is the most costly of the four proposed alternatives, but may not represent a significant increase in effectiveness (exposure reduction) over Alternative No. 2. This alternative is anticipated to take 6 to 7 years to complete.

Minor Changes

1. As explained above in the description of Alternative 2, monthly wet sweeping of Alviso streets has replaced the originally proposed one-time vacuum sweeping.

2. EPA has continued to refine the identification of applicable or relevant and appropriate requirements (ARARs) for the proposed remedial alternatives. The list of ARARs in Section VII for the alternatives is more expansive than described in the Feasibility Study Report. The newly identified ARARs do not sig-

nificantly alter the scope, performance or cost of the remedy. Accordingly, this is a minor change from the earlier remedy selection documentation.

IX. Summary of the Comparative Analysis of Alternatives

This section presents a comparison of alternatives using nine component criteria. These criteria, which are listed below, are derived from requirements contained in the National Contingency Plan and CERCLA Sections 121(b) and 121(c).

1. Protection of human health and the environment.

2. Compliance with ARARs.

3. Reduction of toxicity, mobility, or volume through treatment.

4. Long-term effectiveness or permanence.

5. Short-term effectiveness.

6. Implementability.

7. Cost.

8. State Acceptance.

9. Community Acceptance.

1. Protection of Human Health and the Environment

The truck and industrial yards represent only a portion of the estimated total contaminated area, but present the greatest health risk due to frequent vehicular activities that release asbestos into the air. Alternative No. 2 would eliminate asbestos emissions from the truck and industrial yards (assuming maintenance of the asphalt cover) and remove asbestos laden dust from the streets. These actions would reduce site-wide risk and provide a considerable measure of overall protection. Because soil with low levels of asbestos contamination would remain in other areas of the site, risks from asbestos exposure would not be completely eliminated. The remaining incremental risk would depend on the degree to which these other areas remain undisturbed. Institutional controls, in the form of routine maintenance and deed restrictions, will be implemented on the areas targeted for remediation to ensure protectiveness. Five year reviews will be conducted to evaluate the need for further action should other unpaved areas come into a use that is incompatible with protection of human health and the environment.

Alternative No. 3 would remediate about half of the additional contaminated areas. Significant reduction in risk from inhalation and ingestion would be achieved. Asbestos emissions would be eliminated from all high and medium activity areas with detectable asbestos. Risk would still remain at unremediated locations, but because of the low activity and soil contamination in these areas, the remaining risk would be low and would not significantly impact the site-wide risk.

Alternative No. 4 would be the most protective alternative because all contaminated soil areas would be covered or removed.

The No Action alternative would provide no protectiveness or risk reduction. Risks would remain similar to levels estimated in the Risk Assessment or 10^{-3} at the truck and industrial yards and 10^{-4} to 10^{-6} in the community.

2. Compliance with ARARs

The ARARs pertinent to Alternatives 2 - 4 are set forth in Section VII, above. With stringent dust control and responsible construction practices, all ARARs would be attained by Alternatives No. 2, 3, and 4. The No Action alternative would not attain all ARARs or provide grounds for a waiver, as asbestos emissions would remain uncontrolled.

3. Reduction of Toxicity, Mobility, or Volume

Because there is no feasible treatment technology for asbestos, no remedial alternative for this site utilizes treatment. Therefore, the selected alternative is consistent with the statutory preference for selecting remedies that have as a principal element treatment which permanently and significantly reduces the toxicity, mobility, or volume of the hazardous substances, to the extent that such remedies exist.

4. Long-Term Effectiveness and Permanence

Alternatives 2, 3 and 4 involve placement of resurfacing material over contaminated soil as a means of containment, which will reduce the mobility of the contaminant. The long-term effectiveness of such actions is dependent on proper maintenance of the pavement. If properly maintained, the long-term effectiveness of this remedy is high. Since the remedies involve containment rather than treatment or removal, a quinquennial inspection will be required to assure the continued effectiveness of the containment measures.

Under Alternative No. 2, an asphalt cover that is maintained would be an effective control measure for asbestos emissions from the truck and industrial yards. This action, coupled with wet sweeping of street dust and removal of debris, would provide a high level of long-term human health protection, by remediating the high risk units at the site. Adjacent unremediated areas could potentially contribute to airborne emissions, but contribution of these sources is considered to be minimal due to their low potential for disturbance. Most of the asbestos sources would be contained on site or be transported to an off-site landfill. Long-term effectiveness would be insured by the maintenance of covers and institutional controls.

Alternative 3 and 4 would provide a similar level of long term effectiveness and permanence as Alternative 2, applied over wider areas of coverage as previously described. However, significant risk reduction beyond that already provided by alternative 2 may not be achieved.

5. Short-Term Effectiveness

In the short-term, implementation of Alternative No. 2 may potentially generate visible dust during remediation. Dust control measures would be included to reduce the associated inhalation risk. Construction workers would be protected through compliance with OSHA regulations. Exposures during sweeping will be low since water will be used to reduce dust emissions. Overall, the short-term effectiveness for Alternative No. 2 would be high provided that dust mitigation measures are strictly enforced.

Implementation of Alternative No. 3 would disturb a considerable area with the potential for emissions of asbestos-laden dust. The use of dust suppressants during soil excavation and grading would be necessary to minimize this risk. Dust control for alternatives 3 and 4 would be more difficult than for Alternative 2 since remediation would occur over a larger portion of the site and in less accessible areas such as private yards.

The short term effectiveness of Alternative No. 4 is rated low to moderate because it would take nearly six years to complete. The alternative involves disturbance of presently undisturbed soil and therefore poses a greater risk of airborne asbestos production during remediation than Alternative 2. Area-wide soil disturbance over longer periods of time may increase the risk to public health over the short term.

6. Implementability

Paving, for all alternatives would be implemented utilizing conventional construction techniques and equipment, with special provisions for dust suppression. Paving in general poses no implementation problems; however, site access and preparation may present some problems due to the number of property owners and amount of accumulated construction equipment and debris on the sites that may need to be moved or disposed of. Also, it will be necessary to consider the elevations of existing buildings and driveways in the paving designs. Implementability of sweeping is related to availability of street sweepers, which is not anticipated to be a problem; obtaining water during drought conditions for wet sweeping may be difficult, although reclaimed water sources may be available. Excavation and removal of debris is easy to implement, with the only limitation being landfill capacity.

Alternatives No. 3 and 4 are more difficult to implement than Alternative 2. Remedial work in many of the residential areas would present significant and potentially insurmountable obstacles such as obtaining access to hundreds of private yards. Paving and constructing soil covers in confined areas might require intensive manual labor, as many residential yards may be too small to allow entry of conventional equipment.

7. Cost

The present worth cost of Alternative No. 2 is estimated to be $7,561,000 or an equivalent unit cost of $18/square yard for remediation of 128,500 square yards of truck and industrial yards. The estimated total cost includes the following: Capital cost is estimated to be $5,135,000. Yearly maintenance cost is estimated to be $134,900 and includes yearly inspection and repair/replacement of 5 percent of the asphalt cover. The required 5-year re-evaluation is estimated at $15,000 each, for a total of $90,000 during the 30-year design life.

The present worth cost of Alternative No. 3 is estimated at $30,789,000, or an equivalent unit cost of $44/square yard for remediation of 128,500 square yards of truck and industrial yards, 4,600 square yards of the Sainte Claire Landfill, and 342,000 square yards of residential yards, gardens, business, vacant lots, and landfills. Yearly maintenance is estimated at $233,000 for inspection, repair/replacement of 5 percent of the soil cover, repair/revegetation of 10 percent of the soil cover, and associated site monitoring cost during maintenance. The cost for re-evaluation at 5 year intervals for 30 years is $90,000.

The present worth cost of Alternative No. 4 is estimated at $53,563,000, or an equivalent unit cost of $48/square yards for paving of 128,500 square yards of truck and industrial yards, and 4,600 square yards of the Sainte Claire Landfill, and covering 673,000 square yards of residential yards, gardens, businesses, and landfills. Approximately $26,500,000 (55 percent) of this cost is for off-site disposal of debris. Yearly maintenance is estimated at $316,300. The 5 year re-evaluation is estimated at $90,000 over a 30 year period.

8. <u>State Acceptance</u>

Several State agencies reviewed the Feasibility Study and submitted no technical comments on the alternatives. The California Department of Health Services (DHS) rejected alternative 1. DHS has no objection to alternatives 2, 3, and 4 if all the requirements in the California Environmental Quality Act (CEQA) are complied with; DHS considers that CEQA is a relevant and appropriate requirement if any remedial action other than the no-action alternative (alternative 1) is selected. As a result, DHS has stated that it is unable to concur with this ROD at this time. EPA does not consider CEQA to be an ARAR.

9 . <u>Community Acceptance</u>

Community sentiments vary widely, but there is general support for reducing dust generated by industrial yards. Many Community members have expressed concern that the truck yards and truck traffic are a primary source of the problem. Alternatives 2, 3, and 4 address these concerns. However, there appears to be little support for more widespread action on private property throughout the community (Alternatives 3 and 4). Many comments received during the comment period were concerned with the cost of remediation and who would be financially responsible for those costs.

X. <u>The Selected Remedy</u>

The selected remedy is Alternative No. 2. This alternative involves (1) paving of truck and industrial yards after sampling to determine extent of necessary paving; (2) monthly wet sweeping of Alviso streets; (3) removal of asbestos waste debris (cement pipes, etc); (4) cover inspections and deed restrictions on landfills; and (5) routine maintenance and monitoring. This alternative was selected because it addresses the primary sources of airborne asbestos (i.e., unpaved truck yards with significant traffic; exposed debris containing asbestos; and streets with asbestos dust) in the most cost-effective manner. Paving will be required on areas receiving heavy vehicular traffic that are found to contain greater than 1% asbestos by PLM. The quantity of asbestos released into the air would be reduced, especially in the vicinity of State Street, resulting in a corresponding reduction in health risk.

Although the risk reduction for the other remedial action alternatives may be somewhat greater, the risk reduction was not considered significant when compared to significantly greater costs for Alternatives No. 3 and No. 4. Alternative No. 2 is readily implementable in a shorter period of time compared to other alternatives, and short-term effectiveness can be assured through dust control during remediation. Long-term effectiveness can be assured through maintenance of cover and institutional controls. None of the actions are truly permanent because the contaminants will either be covered in place or hauled to an appropriate off-site landfill. The remedy will require re-evaluation every five years to ensure adequate protectiveness. Although the California Department of Health Services has not concurred with this ROD, DHS has raised no technical objections to the selected remedy. (See IX.8, above.)

XI. Statutory Determinations

The selected remedy will comply with the requirements of Section 121 of CERCLA. The selected remedy will be protective of human health and the environment through containment and removal of the major sources of airborne asbestos within the community. Implementation of the alternative will not pose unacceptable short-term risks.

The selected remedy will comply with all ARARs identified and described in Section VII.

The selected remedy will be cost effective. It achieves a significant reduction in risk at the least cost. Risk reduction of other alternatives was not significantly greater than the selected remedy, but other alternatives were significantly more costly.

The selected remedy is consistent with the statutory preference for selecting remedies that permanently and significantly reduce the toxicity, mobility or volume of the hazardous substances through treatment. The selected remedy is primarily a containment plan and as such does not employ treatment or resource recovery technologies, because treatment technologies that result in permanent destruction or alteration of asbestos are not practicable. Asbestos is a natural fibrous mineral that receives its toxicity due to the form of the fiber. Although reduction in mobility will be achieved through covering and removal of source area, the form of the fiber will not be altered. Reduction in toxicity can only be achieved through destruction or alteration of the fibers. Destruction/alteration is not technically feasible given the large area of contaminated soil and is extremely costly (e.g., energy costs for vitrification). Recovery of asbestos from soils is not appropriate for technological and practical reasons. Asbestos is naturally occurring and because of reduced commercial use, has limited recovery or financial value.

The selected remedy is in compliance with the statutory mandate to utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, since no such technologies are practicable for asbestos. Through placement of cover over asbestos-contaminated soils and the maintenance of the cover, emissions of fibers will be prevented and public health protection achieved.

APPENDIX I

I. Asbestos Analytical Techniques

There are three commonly accepted analytical techniques used to measure asbestos. They are:

1) Phase Contrast Microscopy ("PCM") : An optical technique useful in examining minute dust particles.

2) Polarized Light Microscopy ("PLM"): An optical technique that uses polarized light to identify minerals.

3) Transmission Electron Microscopy ("TEM"): A technique using an electron microscope to achieve extremely high resolution of asbestos fibers too small to be resolved using optical methods.

A brief description, including the advantages and disadvantages of each technique, is presented below.

A. Phase Contrast Microscopy

Phase contrast microscopy ("PCM") is a optical microscopy technique that is commonly used to analyze air samples collected in the work place (e.g. in enclosed spaces). PCM translates differences in the phase of light transmitted or reflected by the object into differences of intensity in the image. Most of the available medical studies of asbestos diseases have measured asbestos using PCM. This is because PCM was the only technique available when most of the occupational studies were done. The method is better suited to analysis of work place air than ambient air because in the work place one may expect a higher fraction of asbestos fibers to total particulates.

The PCM technique has three major limitations concerning its use in the ambient environment. The technique cannot detect fibers with diameters of less than 0.2 micrometers. Many fibers in the environment are much smaller than this. Also, PCM can not distinguish between asbestos fibers and other types of fibers. Therefore, in the environment, the PCM fiber count may be completely unrelated to the asbestos fiber content. For these reasons, it is widely accepted that the PCM method is totally unsuitable for measurement of asbestos fibers in ambient atmospheres.

B. Polarized Light Microscopy

Polarized Light Microscopy ("PLM") is the EPA-approved technique for analysis for bulk insulation samples. The PLM technique is relatively quick (1/2 hour/sample) and can be used to: (1) identify all asbestos types, (2) distinguish between asbestos and other fibrous and non-fibrous minerals and (3) identify most non-asbestos components of samples. The resolution capacity of PLM is 200x to 400x magnification. Another advantage of PLM is that it can be performed for a relatively low cost.

There are two counting procedures for PLM analysis, the point counting method and the field comparison method. The point counting method uses a superimposed grid with 100 points. The operator counts the points where asbestos is present. The point count method involves the preparation of eight slides, each of which can be viewed at 100 possible points, to establish the presence or absence of asbestos at 50 points on each slide. The result is recorded and reported as area percent based on the number of positive points. The following format is used for determination:

Area percent = a/n (100)
where:
a = number of points with asbestos fibers present
n = number of non-empty points counted.

The field comparison method also called "visual estimation" or the 2-minute method with the stereobinocular light microscope, is used to quantify a large sample (e.g., 1 ounce) using the micro- scope at 30-40x. The operator estimates the homogeneity of the mixture and estimates the percentage of each individual fibrous component.

The disadvantages associated with PLM include:

- Asbestos content determination done by visual estimate (field comparison) or point counting is qualitative or at best, semi-quantitive; concentration is expressed as the ratio of asbestos to non-asbestos particles or percent by area.

- Small fiber identification is difficult because certain optical properties (birefringence and the angle of extinction) are hard to determine in small fibers.

- The thinnest fibers that can be observed are approximately 0.4 micrometers in diameter; fibers this small, cannot usually be identified by mineral type. Sample preparation methods (grinding) may reduce size of structures.

o Highly skilled analysts are required, particularly in view of the subjective nature of the determinations.

o The "quantitative" limit of detection is 1 area percent. samples may still contain asbestos in quantities below the PLM detection limit.

o No standardized sample preparation method currently exists, which may cause widely varying analytical results between laboratories.

Using PLM to identify asbestos in soils can be difficult because soils are subjected to erosion and weathering; asbestos bundles become separated and broken into smaller, possibly sub-optical sizes much more quickly than fiber bundles in relatively undisturbed insulating materials. Asbestos fibers may also be dispersed by wind and by seasonal flooding. Therefore, a sizable fraction of the asbestos fibers in soil could be below optical resolution. The EPA method for analysis of bulk insulation has been used as the de facto method for analyzing asbestos in soils, as no other approved method exists.

C. Transmission Electron Microscopy

Transmission electron microscopy ("TEM") is the most powerful analytical method available for measuring asbestos. TEM has been used for air, water, or soil analysis. It is the preferred instrumental technique for measuring asbestos in ambient atmosphere since it incorporates the most powerful combinations of identification methods. TEM analysis uses electron microscopy, at magnifications of 10,000 to 50,000 times, to detect asbestos structures as thin as 0.2 nanometers in diameter. This is sufficient to identify the thinnest asbestos fibrils under most circumstances. The transmission electron microscope allows the operator to locate very small fibers. Two mineral identification tools, Selected Area Electron Diffraction ("SAED") and Energy Dispersive X-ray Analyzer ("EDXA") can then be utilized to identify the mineral type from a single point on the specimen.

The disadvantages associated with TEM include the following:

o No widely accepted TEM method is available for the analysis of asbestos in soils, making it difficult to correlate inter-laboratory data. Sample preparation methods are not standard among workers, making the comparison of results between sites or laboratories very difficult or meaningless.

o Analysis requires a minimum of 6 to 8 hours over 2 to 3 days. Highly skilled analysts are required and large differences in results can occur due to operator variance.

o TEM analysis is extremely expensive, over 20 times the per sample cost of optical methods.

o TEM analysis is performed on much smaller sample than PLM so that obtaining homogeneity during sample preparation is more critical.

o Typically, total structures are counted. Sample preparation (i.e., grinding) destroys the structure size distribution.

Both PLM and TEM sample preparation alters the soil matrix. This is significant because the sample is dispersed into very fine particles before it is put onto a filter for analysis. Since asbestos occurs in clusters and bundles as well as fibers, the sample preparation process (in the case of soil) can destroy the structure of those forms and produce a very large number of individual fibers of small size. Although total fibers are counted as part of the TEM analysis, these results must be converted to weight percent, using data on length, width, and density. This conversion to mass is necessary due to the sample preparation grinding process, which artificially increases the fiber count. How the TEM weight percent compares with air emissions and risk tables has not been standardized by government or industry. Therefore, interpretation of soil data results relative to air samples and/or risk charts is very difficult, at best.

II. Problems With Using Asbestos Data in Quantifying Risk

Although the role of asbestos as a cause of cancer is clear, the ways in which fibers cause disease are not well understood, and this has complicated efforts to measure asbestos successfully. Asbestos researchers have not agreed upon which attributes of asbestos are important to measure to assess risk, including size and shape of individual fibers, number of fibers, total mass of fibers, inclusion of asbestos bundles, clusters, and matrix debris in the fiber count, and asbestos mineralogical type. For example, most researchers think that longer, thinner asbestos fibers, (those longer than 5 microns in length with an aspect ratio greater than 3 to 1) are more carcinogenic, i.e., the "Stanton Hypothesis". However, other researchers question this approach, suggesting that both long and short fibers may be biologically active. In addition to fiber dimension, surface chemistry of the asbestos fiber may play a role in causing disease. Further, there is disagreement whether mineral type is a factor in disease causation. Some would argue that chrysotile asbestos may partially dissolve in weakly acidic environments, facilitating fiber clearance from the lung. However, EPA's view is that all asbestos mineral types are equally carcinogenic.

To compound the problem, analysis of ambient samples for asbestos is much more difficult than occupational or work place samples, because the concentration of asbestos in the environment may be much lower. Asbestos fibers found in ambient air may be too short and thin to be detected by conventional microscopes, and may be agglomerated with other particulate matter so that they are masked or hidden. Further, although EPA has attempted to standardize asbestos analytical techniques, differences in sample handling, preparation, instrument capabilities, operator proficiency, and counting procedures make it extremely difficult to compare results from different laboratories. In short, accurate measurement of asbestos is impeded by many factors, greatly complicating any estimates of environmental risk. For this reason clean up levels have been established using the best available analytical methods. The following discussion summarizes the rationale behind choosing the one area percent by PLM clean up level.

III. Clean Up Goals for the South Bay Asbestos Area Site

Problems with asbestos analytical techniques make establishing health-based clean up levels very difficult. As mentioned above, the clean up level of one area percent by PLM has been chosen because it is the best available analytical technique. This is further evidenced by the fact that EPA chose this method (PLM) for use in the Asbestos Hazard Emergency Response Act ("AHERA"). AHERA specifies that the EPA approved PLM method be used to measure asbestos levels in bulk insulation samples. EPA has promulgated the one area percent clean up level for the South Bay Asbestos Area site because one area percent is the generally accepted detection limit for asbestos in soil using PLM. One area percent by PLM has also been used in the past as an action level in emergency response situations.